

**Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus***

EPA MRID Number 48444809

<b>Data Requirement:</b>	EPA DP Barcode	345709
	EPA MRID	48444809
	EPA Guideline	850.2300

**Test material:** Glufosinate Ammonium Technical      **Purity:** 95.2% w/w

Common name

Chemical name: IUPAC

CAS name

CAS No.

Synonyms

**Primary Reviewer:** Moncie Wright  
Staff Scientist, Cambridge Environmental Inc.

*Moncie V Wright*  
**Signature:**  
**Date:** 7/13/11

**Secondary Reviewer:** Teri S. Myers  
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**Primary Reviewer:** Catherine Aubee  
Biologist, US EPA/OPP/EFED/ERBIV

*C. Aubee*  
**Signature:**  
**Date:** 4 June 2012

**EPA PC Code**      128850

**Date Evaluation Completed:** 04-06-2012

**CITATION:** Schnurstein, A. 2003. Bobwhite quail dietary reproduction study. Unpublished study performed by Aventis Pharma Deutschland GmbH, Testing Facility Kastengrund, Hattersheim, Germany. Report No.: PT03-0091. Study sponsored by Bayer CropScience GmbH – Ecotoxicology, Frankfurt, Germany. Study dated October 31, 2003.

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## **EXECUTIVE SUMMARY**

The one-generation reproductive toxicity of **Glufosinate Ammonium Technical** to groups of 16 pairs of 28 week-old *Colinus virginianus* was assessed over 20 weeks. **Glufosinate Ammonium Technical** was administered to the birds in the diet at nominal concentrations of 660, 1000, or 1500 mg ai/kg diet. Mean-measured concentrations were <LOD (<5, control), 665, 956, and 1444 mg ai/kg diet.

The NOAEC was determined to be 665 mg ai/kg diet based on live embryos of viable embryos at the 956 mg ai/kg diet level (LOAEC) when compared to the control.

No notable treatment related effects were observed for any adult parameter at any of the diet levels tested. One mortality occurred in the control, and one occurred in the lowest test level; however, these mortalities were not treatment-related. Gross necropsies indicated that there were no pathological changes present that could be attributed to the test material. No changes in the reproductive organs were detected.

At the 956 mg ai/kg diet level, there was a 7% (relative to the control), statistically significant ( $p=0.022$ ) reduction in the proportion of live embryos to viable embryos. At the 1444 mg ai/kg diet level, a significant reduction of 14% was observed in the proportion of hatchling survivors to the number hatched ( $p=0.029$ ). No other reproductive parameters were affected.

This toxicity study is scientifically sound and is classified as **acceptable**. It satisfies the OCSPP 850.2300 guideline requirement for an avian reproduction toxicity study with Northern Bobwhite Quail (*Colinus virginianus*).

## **Results Synopsis (mean-measured)**

Test Organism Size/Age(mean Weight): 28 weeks; 205-206 g

NOAEC: 665 mg ai/kg diet (based on live embryos of viable embryos)

LOAEC: 956 mg ai/kg diet (based on live embryos of viable embryos)

Endpoint(s) Affected: live embryos of viable embryos; hatchling survivors of the number hatched

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## I. MATERIALS AND METHODS

### GUIDELINE FOLLOWED:

This study was conducted according to EPA Pesticide Assessment Guidelines, Subdivision E, Hazard Evaluation: Wildlife and Aquatic Organisms, §71-4, "Avian Reproduction Test" (1982); and the OECD Guidelines for the Testing of Chemicals No. 206, "Avian Reproduction Test" (1984). The study methods and results were assessed according to U.S. EPA OPPT 850.2300 and OECD 206 and differences and/or similarities were discussed. Deviations from OCSPP 850.2300 and OECD 206 were noted:

1. Cage size ( $1254 \text{ cm}^2$  per bird) was significantly smaller than recommended by OCSPP guidelines ( $\geq 5,000 \text{ cm}^2$  per bird). However, OECD guidance only suggests a floor space of  $12.5 \text{ cm}^2$  per bird.
2. The physico-chemical properties of the test material were not reported as suggested by both OCSPP and OECD guidelines.

These deviations do not substantively impact the scientific soundness of the study.

### COMPLIANCE:

Signed and dated GLP, Quality Assurance and Data Confidentiality statements were provided. This study was conducted in compliance with the Principles of Good Laboratory Practice (GLP) as described under §19, German Chemical Act (ChemG), Annex 1 (May 8, 2001), which is the implementation of the OECD Principles of GLP as published in the Official Journal of the European Union L77/9 (March 23, 1999).

## A. MATERIALS:

### 1. Test Material

#### Glufosinate Ammonium Technical

### Description:

White powder

### Lot No./Batch No. :

2/93 (batch no.)

### Purity:

95.2% w/w

### Stability of compound under test conditions:

Stability in the treated feed was verified for all dietary concentrations at the beginning of the study (first mixture). After 36 days of storage at room temperature, test concentrations ranged from 96 to 104% of nominal test concentrations. Determination of homogeneity and content of the test material was performed in weeks 0, 4, 8, 12, and 16 of the treatment period. The overall recoveries for the 16 week study period ranged from 95 to 100%.

(OECD recommends water solubility, stability in water and light, pKa, Pow, and vapor pressure of test compound)

### Storage conditions of test chemicals:

The test material was stored at  $25 \pm 5^\circ\text{C}$ .

### Physicochemical properties of Glufosinate Ammonium Technical.

Parameter	Values	Comments

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Parameter	Values	Comments
Water solubility at 20EC	Not reported	
Vapor pressure	Not reported	
UV absorption	Not reported	
pKa	Not reported	
Kow	Not reported	

**2. Test organism:**

**Table 1: Test organism.**

Parameter	Details	Remarks
		Criteria
Species (common and scientific names):	Bobwhite quail ( <i>Colinus virginianus</i> )	<i>Recommended species include a wild waterfowl species, preferably the mallard (<i>Anas platyrhynchos</i>) or an upland game species, preferably the northern bobwhite (<i>Colinus virginianus</i>)</i>
Age at Study Initiation:	<i>Ca. 7 months (28 weeks)</i>	<i>Birds approaching their first breeding season should be used.</i>
Body Weight: (mean and range)	Males: $205 \pm 13.7$ g (n=64) Females: $206 \pm 13.7$ g (n=64)	<i>Body weights should be recorded at test initiation and at biweekly intervals up to week eight or up to the onset of egg laying and at termination.</i>
Source:	Birds were obtained from Geflugelzucht Kuberich, 97353 Wiesentheit, Germany	All birds were pen-reared and phenotypically indistinguishable from wild birds. Sexing was done by visual inspection of plumage markings and external genital organs. <i>All birds should be from the same source.</i>

**B. STUDY DESIGN:**

**1. Experimental Conditions**

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a. Range-finding study A range-finding study was not conducted.

b. Definitive Study

**Table 2: Experimental Parameters.**

Parameter	Details	Remarks
		Criteria
Acclimation period:	At least 2 weeks	
Conditions (same as test or not):	Same as test (birds were acclimated to caging and facilities)	<i>Recommended observation period includes a 2-3 week health observation period prior to selection of birds for treatment. Generally, birds should be healthy without excess mortality. Feeding should be <u>ad libitum</u>, and sickness, injuries or mortality should be noted.</i>
Feeding:	Birds were fed a special quail grower diet prepared by ssniff GmbH. Feed and tap water were provided <u>ad libitum</u> .	
Health (any mortality observed):	No mortality was reported.	
<u>Test duration</u> pre-laying exposure: egg-laying exposure: withdrawal period, if used:	10 weeks 10 weeks N/A	<i><u>Recommended pre-laying exposure duration:</u> At least 10 weeks prior to the onset of egg-laying. <u>Recommended exposure duration with egg-laying:</u> At least 10 weeks. <u>Recommended withdrawal period:</u> If reduced reproduction is evident, a withdrawal period of up to 3 weeks should be added to the test phase.</i>
<u>Pen (for parental and offspring)</u> size:  construction materials:  number:	Adult pens measured 76 x 33 x 24 cm; pens had a sloping floor and an egg catcher. Offspring had a reported floor space of at least 50 cm <sup>2</sup> per chick.  Adult pens were constructed of wire mesh. Offspring were housed in plastic boxes with corrugated cardboard strewn with quartz sand.  Adults: 16 per control and treatment level Offspring: chicks were housed according to treatment group	<i><u>Pens</u> Pens should have adequate room and be arranged to prevent cross-contamination. <u>Materials</u> Recommended materials include nontoxic material and nonbinding material, such as galvanized steel. <u>Number</u> At least 5 replicate pens should be used for mallards housed in groups of 7. For other arrangements, at least 12 pens should be used, but considerably more may be used if birds are kept in pairs. Chicks should be housed according to parental grouping.</i>

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<b>Parameter</b>	<b>Details</b>	<b>Remarks</b>
		<b>Criteria</b>
Number of birds per pen (male:female)	2 birds per pen (1 male:1 female)	<i>One male and one female per pen should be used. For quail, one male and two females should be used. For ducks, two males and five females should be used.</i>
<u>Number of pens per group/treatment</u> negative control: solvent control: treated:	16 N/A 16	<i>At least 12-16 pens should be used, but considerably more if birds are kept in pairs.</i>
<u>Test concentrations (mg ai/kg diet)</u> nominal:  measured:	0 (control), 660, 1000, and 1500 mg ai/kg diet  <LOD (<5, control), 665, 956, and 1444 mg ai/kg diet	<i>Recommended test concentrations include at least two concentrations other than the control; three or more will provide a better statistical analysis. The highest test concentrations should show a significant effect or be at or above the actual or expected field residue level.</i>
Maximum labeled field residue anticipated and source of information:	Not reported	<i>The highest test concentrations should show a significant effect or be at or above the actual or expected field residue level. The source (i.e., maximum label rate in lb ai/A and ppm), label registration no., label date, and site should be cited]</i>
Solvent/vehicle, if used type: amount:	N/A- no solvent was used	<i>Recommended solvents include corn oil or other appropriate vehicle not more than 2% of diet by weight</i>
Was detailed description and nutrient analysis of the basal diet provided (Yes/No)	Yes  <u>ssniff diet for quails – rearing:</u> Crude protein: 26% Crude fat: 5% Crude fiber: 3.5%  <u>ssniff diet for quails – breeding:</u> Crude protein: 25% Crude fat: 5% Crude fiber: 3.5%	<u>ssniff diet for quails – rearing:</u> Crude protein: 26% Crude fat: 5% Crude fiber: 3.5% <u>ssniff diet for quails – breeding:</u> Crude protein: 25% Crude fat: 5% Crude fiber: 3.5%

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<b>Parameter</b>	<b>Details</b>	<b>Remarks</b>
		<b>Criteria</b>
		<i>A commercial breeder feed or an equivalent that is appropriate for the test species is recommended.</i>
Preparation of test diet	The test material was mixed directly with the diet without using a solvent. Each dose level was prepared from an individual high concentration pre-mix, which was diluted with an appropriate quantity of untreated diet. The treated diet was mixed for 30 minutes in a precision mixer.	<i>A premixed diet containing the test substance should be mechanically mixed with basal diet. If an evaporative vehicle is used, it should be completely evaporated prior to feeding.</i>
Indicate whether stability and homogeneity of test material in diet determined (Yes/No)	Yes. Three samples (top, middle, and bottom of the mixture) were taken from each diet mixture after preparation. Homogeneity and content of the test material were determined at weeks 0, 4, 8, 12, and 16. Stability was determined at study initiation (first mixture).	
Were concentrations in diet verified by chemical analysis?	Yes. Test concentrations were verified via reverse phase HPLC with UV detection (200 nm).	
Did chemical analysis confirm that diet was stable and homogeneous?	Yes. Refer to Section A-1 of the DER.	
Feeding and husbandry	Feeding and husbandry conditions appeared to be adequate, given guideline recommendations.	
<u>Test conditions (pre-laying)</u> temperature: relative humidity: photoperiod:	20-24°C 20-70% 8L:16D	<i>Recommended temperature: about 21EC (70EF) Recommended relative humidity: about 55% Recommended lighting First 8 weeks: 7 h per day. Thereafter: 16-17 h per day. At least 6 foot-candles are recommended at bird level.</i>
<b>Egg Collection and Incubation</b>		
<u>Egg collection and storage</u>		

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Parameter	Details	Remarks
		Criteria
collection interval: storage temperature: storage humidity:	Daily 12-16°C ca. 70%	Eggs should be collected daily; recommended egg storage temperature is approximately 16EC (61EF); recommended humidity is approximately 65%. Recommended collection interval: daily
Were eggs candled for cracks prior to setting for incubation?	Yes.	Eggs should be candled on day 0
Were eggs set weekly?	Yes.	
When candling was done for fertility?	Eggs were candled again on Days 8 and 11 (embryo viability) and 18 (viable 3-week embryos).	Quail: approx. day 11 Ducks: approx. day 14
When the eggs were transferred to the hatcher?	Day 22 of incubation	Bobwhite: usually day 21 Mallard: usually day 23
<u>Hatching conditions</u> temperature: humidity: photoperiod:	Lowered from $37.5 \pm 0.2^{\circ}\text{C}$ by $0.3^{\circ}\text{C}$ ca. 80% Not reported	During the first 21 days of incubation, the temperature in the incubator was $37.5 \pm 0.2^{\circ}\text{C}$ and the relative humidity was ca. 60-70%.  Recommended temperature is 39EC (102EF) Recommended humidity is 70%
Day the hatched eggs were removed and counted	Day 25/26	Eggs for bobwhite should be removed on day 24; for mallard on day 27
Were egg shells washed and dried for at least 48 hrs before measuring?	No; the shells were dried for 24 hours in a drying cabinet at 60°C.	
<u>Egg shell thickness</u> no. of eggs used:  intervals:  mode of measurement:	16 eggs per control and treatment group  Once every two weeks (weeks 13, 15, 17, and 19)  Four points along the fractured edge around the waist of the shell was measured to the nearest 0.001 mm.	Newly hatched eggs should be collected at least once every two weeks. Thickness of the shell plus membrane should be measured to the nearest 0.01 mm with 3 - 4 measurements per shell.

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Parameter	Details	Remarks
		Criteria
Reference chemical, if used	N/A	

**2. Observations:**

**Table 3: Observations.**

Parameter	Details	Remarks
<b>Parameters measured</b>		
Parental (mortality, body weight, mean feed consumption)	- mortality - body weight - food consumption	<i>Recommended endpoints measured include:</i>
Egg collection and subsequent development (no. of eggs laid, no. of eggs cracked, shell thickness, no. of eggs set, no. of viable embryos, no. of live 3 week embryos, no. hatched, no. of 14-day survivors, average weight of 14-d old survivors, mortality, gross pathology, others)	- signs of toxicity - necropsy  - eggs laid - eggs cracked - eggs normal - egg shell thickness - eggs set - egg weight - viable embryos - live 3-week embryos - hatchlings - hatchling body weight - 14-day-old survivors - 14-day-old survivor body weight - signs of toxicity of hatchlings - hatchling feed consumption	<ul style="list-style-type: none"> <li>• Eggs laid/pen</li> <li>• Eggs cracked/pen</li> <li>• Eggs set/pen</li> <li>• Viable embryos/pen</li> <li>• Live 3-week embryos/pen</li> <li>• Normal hatchlings/pen</li> <li>• 14-day-old survivors/pen</li> <li>• 14-day-old survivors/pen</li> <li>• Weights of 14-day-old survivors (mean per pen)</li> <li>• Egg shell thickness</li> <li>• Food consumption (mean per pen)</li> <li>• Initial and final body weight (mean per pen)</li> </ul>
Indicate if the test material was regurgitated	No indications of dietary regurgitation.	
Observation intervals (for various parameters)	Parental and hatchling mortality and signs of toxicity were recorded daily (twice daily for hatchlings). Parental body weights were recorded at Weeks 2, 4, 6, 8, and 20. Offspring were weighed at hatch and at 14 days. Parental food consumption was measured weekly.	<i>Body weights and food consumption should be measured at least biweekly</i>
Were raw data included?	Yes	

**II. RESULTS AND DISCUSSION:**

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## A. MORTALITY:

Treatment-related mortality did not occur in the control or diet levels. However, due to a panic of the birds in the study room on days 55-56, one female in the control was found dead with an open head wound. Her pen mate was euthanized.

Additionally, on day 115 one hen in the nominal 660 mg ai/kg diet level group was found dead with her head and neck caught in the gap between the egg-catcher and the cage door; the neck injuries indicated that the hen died from panic escape attempts. Her pen mate was euthanized.

**Table 4: Effect of Glufosinate Ammonium Technical on Mortality of *Colinus virginianus*.**

Treatment (mg ai/kg diet) Mean-measured (and nominal)	Observation Period					
	Day 1		Day 56		Day 115	
	No. Dead Male	No. Dead Female	No. Dead Male	No. Dead Female	No. Dead Male	No. Dead Female
Control	0	0	1	1	0	0
665 (660)	0	0	0	0	1	1
956 (1000)	0	0	0	0	0	0
1444 (1500)	0	0	0	0	0	0

## B. REPRODUCTIVE AND OTHER ENDPOINTS:

**Abnormal Effects/Behavior:** Due to the panic of the birds in the study room on days 55-56, 16 surviving birds from all test groups received open head injuries and two birds were swollen in the area surrounding their left eyes. The reviewer confirmed that the injuries were evenly distributed across control and treatment groups. Head injuries were medicated daily with Lavasept (0.2%), and swelling was treated with Hirodoid salve. All injured birds were kept separately from their pen mates until they were cured. By day 70 at the start of the reproduction period, all affected animals had recovered. However, there were a few observations of eschar on the affected areas on the birds' heads. Two females retained eschar throughout the entire study period. From days 102 to 107 one hen in the nominal 660 mg ai/kg diet level group suffered from a foot injury, which was treated daily with Lavasept (0.2%).

**Necropsy:** Gross necropsies indicated that there were no pathological changes present that could be attributed to the test material. No changes in the reproductive organs were detected.

**Food Consumption:** No changes in food consumption were observed in any of the three diet levels.

**Body Weight:** No changes in body weight gain were observed in any of the three diet levels. However, a slight decrease in body weight gain among the females in the nominal 660 mg ai/kg diet level group was noted during weeks 0 to 2. This finding was considered incidental due to the absence of confirmatory findings at the higher treatment groups.

**Reproductive Effects:** Egg production was unaffected at all diet levels. The number of eggs laid, cracked eggs, abnormal eggs, egg weight, and shell thickness indicated no treatment-related changes. No statistically significant differences were observed in the diet levels as compared to the control for fertile eggs/incubated eggs, live 3-week embryos/fertile eggs, chicks hatched/live 3-week embryos, chicks hatched/fertile eggs, and chicks hatched/incubated eggs. No statistically significant differences were determined for 14-day survivors/chicks hatched, 14-day survivors/incubated eggs, and 14-day survivors/hen. Additionally, no statistically significant differences were found for chick weight at hatching and at day 14. Chick food

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consumption was also not affected.

**Table 5: Reproductive and Other Parameters (nominal concentrations; study author-reported).**

Parameter	Control	660 mg/kg	1000 mg/kg	1500 mg/kg	NOAEC/ LOAEC
Eggs laid/pen	46.8	50.9	38.5	47.3	1500 mg/kg >1500 mg/kg
Eggs cracked	0.73	0.69	0.99	1.13	1500 mg/kg >1500 mg/kg
Eggs set	637	693	560	681	Not reported
Shell thickness (mm $\pm$ SD)	0.203	0.202	0.206	0.204	1500 mg/kg >1500 mg/kg
Viable embryos	478	579	499	551	Not reported
Live 3-week embryos	464	567	464	539	Not reported
Live 3-week embryos/fertile eggs	98	98	91	98	1500 mg/kg >1500 mg/kg
No. of hatchlings	425	527	420	492	Not reported
Chicks hatched/live 3-week embryos	92	93	91	91	1500 mg/kg >1500 mg/kg
Chicks hatched/fertile eggs	90	91	83	89	1500 mg/kg >1500 mg/kg
Chicks hatched/incubated eggs	65	76	73	72	1500 mg/kg >1500 mg/kg

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Hatching weight	7.0	7.2	7.3	6.9	1500 mg/kg >1500 mg/kg
14-day old survivors	344	408	342	352	Not reported
14-day old survivors/hatchlings	84	67	78	72	1000 mg/kg 1500 mg/kg
14-day old survivors/eggs fertile	76	61	66	64	1000 mg/kg 1500 mg/kg
14-day old survivors weight	25.0	24.0	26.5	25.4	1500 mg/kg >1500 mg/kg
Mean food consumption	34.7	34.8	35.0	34.8	1500 mg/kg >1500 mg/kg
Weight of females (parent) at test initiation: at test termination:	206.4 244.2	208.3 250.1	207.5 239.4	201.4 235.4	1500 mg/kg >1500 mg/kg
Weight of males (parent) at test initiation: at test termination:	200.6 210.9	205.5 216.3	203.6 207.6	208.4 218.2	1500 mg/kg >1500 mg/kg
Gross pathology	Males: Head/neck/back /breast	Females: No feathers	4 males affected 7 females affected	9 females affected	3 males affected 12 females affected
					7 males affected 8 females affected
					1500 mg/kg >1500 mg/kg

**C. REPORTED STATISTICS:**

The weight gain and food consumption data were analyzed using one-sided Dunnett tests and two-sided Dunnett tests ( $\alpha=0.05$ ). For egg quality, incubated egg development, and hatching weights, pairwise comparisons between control and treatment groups were conducted via exact one-sided rank sum tests ( $\alpha=0.05$ ).

**D. VERIFICATION OF STATISTICAL RESULTS:**

Statistical Method: Analysis was conducted using “chicks.sas” (Ver. 3; March 2002), a SAS program provided by EFED/OPP/USEPA. Data for all endpoints were examined graphically using box plots to determine if they exhibited a dose-dependent response, which was ultimately used to select the multiple comparison test to detect

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LOAEC and NOAEC. Data for each endpoint were tested to determine if their distributions were normal and if their variances were homogeneous using Shapiro-Wilk's and Levene's tests, respectively. Data that satisfied these assumptions were subjected to Dunnett's and William's tests and data that did not satisfy these assumptions were subjected to the non-parametric MannWhitney-U (with a Bonferroni adjustment) and Jonckheere's tests. Data for dead birds were excluded from the analyses. See Appendix I for output of reviewer's statistical verification and graphs for affected endpoints to support any reviewer-generated conclusions that may differ from those reported in the study.

NOAEC: 665 mg ai/kg diet (based on live embryos of viable embryos)

LOAEC: 956 mg ai/kg diet (based on live embryos of viable embryos)

Endpoint(s) Affected: live embryos of viable embryos; hatchling survivors of the number hatched

**Table 6: Reproductive and Other Parameters (mean-measured concentrations; reviewer-reported).**

Parameter	Control	665 mg/kg	956 mg/kg	1444 mg/kg	NOAEC/ LOAEC
Eggs laid/pen	46.8	50.9	38.5	47.3	1444 mg/kg >1444 mg/kg
Eggs cracked/pen	0.33	0.33	0.19	0.56	1444 mg/kg >1444 mg/kg
Eggs not cracked/eggs laid (%)	99	99	99	99	1444 mg/kg >1444 mg/kg
Eggs set/pen	42.5	46.2	35	42.6	1444 mg/kg >1444 mg/kg
Shell thickness	0.20	0.20	0.21	0.20	1444 mg/kg >1444 mg/kg
Eggs set/eggs laid (%)	90	90	90	90	1444 mg/kg >1444 mg/kg
Viable embryos/pen	31.9	38.6	31.2	34.4	1444 mg/kg >1444 mg/kg

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Viable embryos/eggs set (%)	72	84	87	81	1444 mg/kg >1444 mg/kg
Live embryos/pen	30.9	37.8	29	33.5	1444 mg/kg >1444 mg/kg
Live embryos/viable embryos (%)	98	98	91*	97	665 mg/kg 956 mg/kg
No. of hatchlings/pen	28.3	35.1	26.3	30.8	1444 mg/kg >1444 mg/kg
No. of hatchlings/eggs laid (%)	58.2	68.3	65.2	64.5	1444 mg/kg >1444 mg/kg
No. of hatchlings/eggs set (%)	65	76	72	72	1444 mg/kg >1444 mg/kg
No. of hatchlings/live embryos (%)	92	93	91	92	1444 mg/kg >1444 mg/kg
Hatching survival/pen	22.93	25.4	21.4	22	1444 mg/kg >1444 mg/kg
Hatching survival/eggs set (%)	53	54	57	51	1444 mg/kg >1444 mg/kg
Hatching survival/no. of hatchlings (%)	84	67	78	72*	956 mg/kg 1444 mg/kg
Hatching weight (g)	7.02	7.21	7.26	6.88	1444 mg/kg >1444 mg/kg
Survivor weight (g)	24.9	24	26.5	25.4	1444 mg/kg >1444 mg/kg

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Mean food consumption (g/bird/day)	34.9	35	34.7	34.8	1444 mg/kg >1444 mg/kg
Male weight gain (g)	9.9	11.3	4.0	9.8	1444 mg/kg >1444 mg/kg
Female weight gain (g)	39.3	40.8	31.9	33.9	1444 mg/kg >1444 mg/kg

\* statistically-significant at p<0.05

## E. STUDY DEFICIENCIES:

There were no major study deficiencies. Minor deviations noted in the preceding section do not substantively impact the scientific soundness or interpretation of this study.

## F. REVIEWER'S COMMENTS:

The reviewer's and the study author's results were in agreement for the determination of statistically significant reductions at the 956 (1000) mg ai/kg test level for hatchling survivors of the number hatched. However, the reviewer determined statistically significant reductions for live embryos of viable embryos at the 665 mg ai/kg diet level while the study author did not analyze this endpoint. Additionally, the study author determined there were significant reductions for 14-day survivors of eggs fertile (a.k.a. viable embryos) at the 1000 mg ai/kg diet level; however, this was not an endpoint typically analyzed by the Chicks program thus the reviewer could not verify this analysis. The reviewer's results, based on mean-measured concentrations, are reported in the Executive Summary and Conclusions sections of the DER.

Mean-measured concentrations in the treated feed were reviewer-calculated using data provided for the homogeneity samples (see copy of associated Excel worksheet in Appendix II).

For homogeneity assessments, one sample was collected from the top, middle, and bottom of the diet mixture. The samples were collected at five diet mix events (weeks 0, 4, 8, 12, and 16) and homogeneity assessments were performed on six different dates.

Treatment was initiated March 31, 2003, and the end of the study was September 25, 2003.

## G. CONCLUSIONS:

This toxicity study is scientifically sound and is classified as **acceptable**. It satisfies the OCSPP 850.2300 guideline requirement for an avian reproduction toxicity study with Northern Bobwhite Quail (*Colinus virginianus*). No notable treatment related effects were observed for any adult parameter at any of the diet levels tested. At the 956 mg ai/kg diet level, there was a treatment-related effect on the proportion of live embryos of viable embryos. At the 1444 mg ai/kg diet level, there was a treatment-related effect on the proportion of hatchling survivors of the number hatched. No other reproductive parameters were affected.

NOAEC: 665 mg ai/kg diet (based on live embryos of viable embryos)

LOAEC: 956 mg ai/kg diet (based on live embryos of viable embryos)

Endpoint(s) Affected: live embryos of viable embryos; hatchling survivors of the number hatched

**Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on  
Avian Species *Colinus virginianus***

EPA MRID Number 48444809

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**III. REFERENCES:**

N/A





**Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on  
Avian Species *Colinus virginianus***

EPA MRID Number 48444809

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# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
 ANALYSIS RESULTS FOR VARIABLE EL ( Eggs Laid )

TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS  
 Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
 Levenes test for homogeneity of variance (absolute residuals) -- alpha-level=0.05  
 Use parametric analyses if neither test rejected, otherwise non-parametric analyses.  

Shapiro-Wilks Test Stat	Shapiro-Wilks P-value	Levenes Test Stat	Levenes P-value	Conclusion
0.978	0.332	1.622	0.194	USE PARAMETRIC TESTS

\*\*\*\*\*  
 BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	46.80	14.02	3.62	29.95	39.04, 54.56
Dose1	15	50.93	8.30	2.14	16.30	46.34, 55.53
Dose2	16	38.50	15.30	3.82	39.73	30.35, 46.65
Dose3	16	47.31	14.62	3.66	30.91	39.52, 55.10

Level	Median	Min	Max	% of Control(means)	% Reduction(means)
Ctrl	50.00	27.00	70.00	.	.
Dose1	53.00	34.00	62.00	108.83	-8.83
Dose2	40.00	9.00	63.00	82.26	17.74
Dose3	46.00	14.00	67.00	101.10	-1.10

\*\*\*\*\*  
 PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests  
 Analysis of Variance (ANOVA) - overall F-test  

Numerator df	Denominator df	F-stat	P-value
3	58	2.41	0.076

Dunnett - testing each trt mean signif. less than control  
 Williams - test assumes dose-response relationship, testing negative trend  
 Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic mean	Williams p-value	Tukey p-values				
					Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	46.80	.	48.87	.	0.833	0.322	1.000	.	.
Dose1	50.93	0.948	48.87	0.750	.	0.059	0.876	.	.
Dose2	38.50	0.107	42.91	0.270	.	.	0.257	.	.
Dose3	47.31	0.784	42.91	0.280	.	.	.	.	.

SUMMARY

Dunnett	NOEC	LOEC
	Dose3	>highest dose
Williams	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE NEG\_EC ( Eggs Cracked )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.713	<.001	3.212	0.029	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	0.33	0.62	0.16	185.16	0.00, 0.68
Dose1	15	0.33	0.62	0.16	185.16	0.00, 0.68
Dose2	16	0.19	0.40	0.10	214.99	0.00, 0.40
Dose3	16	0.56	1.03	0.26	183.25	0.01, 1.11

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	0.00	0.00	2.00	.	.
Dose1	0.00	0.00	2.00	100.00	0.00
Dose2	0.00	0.00	1.00	56.25	43.75
Dose3	0.00	0.00	3.00	168.75	-68.75

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	0.96	0.811

MannWhit(Bon) - testing each trt median signif. greater than control

Jonckheere - test assumes dose-response relationship, testing positive trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	0.00	.	.
Dose1	0.00	1.000	0.500
Dose2	0.00	1.000	0.725
Dose3	0.00	1.000	0.415

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose3	>highest dose
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE ENC\_EL ( (EL-EC)/EL (%) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.584	<.001	0.673	0.572	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	99.27	1.34	0.35	1.35	98.53, 100.00
Dose1	15	99.31	1.37	0.35	1.38	98.54, 100.00
Dose2	16	99.01	2.82	0.70	2.84	97.51, 100.00
Dose3	16	98.87	2.17	0.54	2.20	97.72, 100.00

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	100.00	96.00	100.00	.	.
Dose1	100.00	95.24	100.00	100.03	-0.03
Dose2	100.00	88.89	100.00	99.73	0.27
Dose3	100.00	92.50	100.00	99.60	0.40

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	0.48	0.924

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	100.00	.	.
Dose1	100.00	1.000	0.511
Dose2	100.00	1.000	0.662
Dose3	100.00	1.000	0.429

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose3	>highest dose
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE ES (Eggs Set)

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks Test Stat	Shapiro-Wilks P-value	Levenes Test Stat	Levenes P-value	Conclusion
0.976	0.274	1.361	0.264	USE PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	42.47	13.39	3.46	31.53	35.05, 49.88
Dose1	15	46.20	8.46	2.18	18.32	41.51, 50.89
Dose2	16	35.00	14.41	3.60	41.18	27.32, 42.68
Dose3	16	42.56	13.59	3.40	31.93	35.32, 49.80

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	46.00	24.00	64.00	.	.
Dose1	48.00	28.00	56.00	108.79	-8.79
Dose2	36.50	6.00	58.00	82.42	17.58
Dose3	39.50	12.00	62.00	100.23	-0.23

\*\*\*\*\*

## PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	58	2.14	0.105

Dunnett - testing each trt mean signif. less than control

Williams - test assumes dose-response relationship, testing negative trend

Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic mean	Williams p-value	Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	42.47	.	44.33	.	0.853	0.369	1.000	.	.
Dose1	46.20	0.943	44.33	0.743	.	0.079	0.856	.	.
Dose2	35.00	0.125	38.78	0.271	.	.	0.343	.	.
Dose3	42.56	0.755	38.78	0.281	.	.	.	.	.

SUMMARY	NOEC	LOEC
Dunnett	Dose3	>highest dose
Williams	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE ES\_EL ( EggsSet/EggsLaid (%) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.678	<.001	0.483	0.696	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	90.37	3.03	0.78	3.35	88.69, 92.05
Dose1	15	90.38	2.99	0.77	3.31	88.72, 92.04
Dose2	16	89.58	6.31	1.58	7.05	86.21, 92.94
Dose3	16	89.70	3.86	0.96	4.30	87.64, 91.75

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	91.23	83.72	93.55	.	.
Dose1	91.07	82.35	93.10	100.01	-0.01
Dose2	91.41	66.67	93.02	99.12	0.88
Dose3	91.20	80.85	92.98	99.26	0.74

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	0.10	0.992

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	91.23	.	.
Dose1	91.07	1.000	0.492
Dose2	91.41	1.000	0.460
Dose3	91.20	1.000	0.379

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose3	>highest dose
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE VE ( Viable Embryo(d14) )

TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS  
Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.  
Shapiro-Wilks    Shapiro-Wilks    Levenes    Levenes    Conclusion  
Test Stat      P-value      Test Stat      P-value  
0.976           0.275        1.165        0.331        USE PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	31.87	20.42	5.27	64.08	20.56, 43.17
Dose1	15	38.60	14.44	3.73	37.40	30.61, 46.59
Dose2	16	31.19	15.34	3.84	49.19	23.01, 39.36
Dose3	16	34.44	17.00	4.25	49.36	25.38, 43.50

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	31.00	1.00	60.00	.	.
Dose1	43.00	1.00	53.00	121.13	-21.13
Dose2	31.50	6.00	57.00	97.87	2.13
Dose3	32.00	0.00	60.00	108.07	-8.07

\*\*\*\*\*

PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	58	0.60	0.618

Dunnett - testing each trt mean signif. less than control

Williams - test assumes dose-response relationship, testing negative trend

Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic mean	Williams p-value	Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	31.87	.	35.23	.	0.697	0.999	0.974	.	.
Dose1	38.60	0.971	35.23	0.791	.	0.618	0.903	.	.
Dose2	31.19	0.705	32.81	0.684	.	.	0.948	.	.
Dose3	34.44	0.874	32.81	0.702	.	.	.	.	.

SUMMARY	NOEC	LOEC
Dunnett	Dose3	>highest dose
Williams	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE VE\_ES ( ViableEmbryo/EggsSet (%) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.813	<.001	2.925	0.041	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	72.05	36.33	9.38	50.42	51.93, 92.17
Dose1	15	83.57	26.10	6.74	31.23	69.12, 98.03
Dose2	16	87.37	16.21	4.05	18.55	78.74, 96.01
Dose3	16	80.52	27.47	6.87	34.11	65.88, 95.15

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	93.75	2.08	100.00	.	.
Dose1	94.44	2.08	100.00	115.99	-15.99
Dose2	93.89	54.29	100.00	121.27	-21.27
Dose3	96.38	0.00	100.00	111.75	-11.75

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	0.11	0.991

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	93.75	.	.
Dose1	94.44	1.000	0.450
Dose2	93.89	1.000	0.572
Dose3	96.38	1.000	0.563

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose3	>highest dose
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE LE ( Live Embryo(d21) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.973	0.185	0.877	0.458	USE PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	30.93	19.60	5.06	63.38	20.08, 41.79
Dose1	15	37.80	14.46	3.73	38.26	29.79, 45.81
Dose2	16	29.00	15.19	3.80	52.37	20.91, 37.09
Dose3	16	33.50	17.10	4.27	51.04	24.39, 42.61

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	30.00	1.00	56.00	.	.
Dose1	43.00	1.00	53.00	122.20	-22.20
Dose2	30.00	4.00	53.00	93.75	6.25
Dose3	31.50	0.00	60.00	108.30	-8.30

\*\*\*\*\*

## PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	58	0.80	0.501

Dunnett - testing each trt mean signif. less than control

Williams - test assumes dose-response relationship, testing negative trend

Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic mean	Williams p-value	Tukey p-values				
					Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	30.93	.	34.37	.	0.675	0.988	0.973	.	.
Dose1	37.80	0.974	34.37	0.797	.	0.464	0.890	.	.
Dose2	29.00	0.618	31.25	0.641	.	.	0.871	.	.
Dose3	33.50	0.875	31.25	0.659	.	.	.	.	.

## SUMMARY

Dunnett	NOEC	LOEC
Williams	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE LE\_VE ( LiveEmbryo/ViableEmbryo (%) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.830	<.001	4.949	0.004	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	97.71	2.88	0.74	2.95	96.11, 99.30
Dose1	15	97.84	3.09	0.80	3.16	96.13, 99.55
Dose2	16	91.00	9.30	2.32	10.22	86.05, 95.96
Dose3	15	96.80	5.11	1.32	5.28	93.97, 99.63

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	100.00	91.67	100.00	.	.
Dose1	100.00	89.29	100.00	100.14	-0.14
Dose2	93.63	66.67	100.00	93.14	6.86
Dose3	100.00	84.00	100.00	99.07	0.93

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	10.36	0.016

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	100.00	.	.
Dose1	100.00	1.000	0.580
Dose2	93.63	0.022	0.004
Dose3	100.00	1.000	0.154

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose1	Dose2
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE NH ( Number Hatched )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.971	0.150	0.786	0.507	USE PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	28.33	18.18	4.69	64.15	18.27, 38.40
Dose1	15	35.13	13.85	3.58	39.42	27.46, 42.80
Dose2	16	26.25	14.05	3.51	53.54	18.76, 33.74
Dose3	16	30.75	15.97	3.99	51.94	22.24, 39.26

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	26.00	1.00	50.00	.	.
Dose1	37.00	1.00	51.00	124.00	-24.00
Dose2	27.50	4.00	46.00	92.65	7.35
Dose3	28.50	0.00	57.00	108.53	-8.53

\*\*\*\*\*

## PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	58	0.92	0.437

Dunnett - testing each trt mean signif. less than control

Williams - test assumes dose-response relationship, testing negative trend

Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic mean	Williams p-value	Tukey p-values				
					Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	28.33	.	31.73	.	0.633	0.982	0.973	.	.
Dose1	35.13	0.978	31.73	0.807	.	0.395	0.862	.	.
Dose2	26.25	0.596	28.50	0.631	.	.	0.847	.	.
Dose3	30.75	0.876	28.50	0.649	.	.	.	.	.

## SUMMARY

Dunnett	NOEC	LOEC
Williams	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE NH\_EL ( NumberHatched/EggsLaid (%) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.882	<.001	2.048	0.117	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	58.21	30.46	7.87	52.33	41.34, 75.08
Dose1	15	68.33	21.82	5.63	31.93	56.25, 80.41
Dose2	16	65.23	17.32	4.33	26.55	56.00, 74.46
Dose3	16	64.45	24.04	6.01	37.29	51.65, 77.26

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	70.00	1.89	86.79	.	.
Dose1	75.51	1.89	87.93	117.38	-17.38
Dose2	72.82	33.33	90.00	112.06	-12.06
Dose3	72.75	0.00	87.72	110.72	-10.72

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	0.81	0.847

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	70.00	.	.
Dose1	75.51	1.000	0.705
Dose2	72.82	1.000	0.404
Dose3	72.75	1.000	0.487

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose3	>highest dose
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE NH\_ES ( NumberHatched/EggsSet (%) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.868	<.001	2.465	0.071	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	64.58	33.65	8.69	52.11	45.94, 83.22
Dose1	15	75.62	23.96	6.19	31.68	62.36, 88.89
Dose2	16	72.49	17.23	4.31	23.76	63.31, 81.67
Dose3	16	72.00	26.53	6.63	36.85	57.86, 86.14

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	80.56	2.08	96.30	.	.
Dose1	84.09	2.08	94.44	117.10	-17.10
Dose2	79.43	37.50	97.30	112.25	-12.25
Dose3	83.53	0.00	94.34	111.49	-11.49

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	0.99	0.805

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	80.56	.	.
Dose1	84.09	1.000	0.668
Dose2	79.43	1.000	0.358
Dose3	83.53	1.000	0.540

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose3	>highest dose
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE NH<sub>LE</sub> ( NumberHatched/LiveEmbryo (%) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.930	0.002	1.593	0.201	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	92.17	7.91	2.04	8.59	87.79, 96.55
Dose1	15	93.21	5.46	1.41	5.86	90.19, 96.24
Dose2	16	90.92	7.91	1.98	8.70	86.71, 95.14
Dose3	15	91.62	4.80	1.24	5.23	88.96, 94.28

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	96.30	75.00	100.00	.	.
Dose1	95.24	84.00	100.00	101.13	-1.13
Dose2	92.15	68.18	100.00	98.65	1.35
Dose3	91.43	80.77	100.00	99.41	0.59

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	1.24	0.745

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	96.30	.	.
Dose1	95.24	1.000	0.483
Dose2	92.15	0.796	0.224
Dose3	91.43	0.827	0.142

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose3	>highest dose
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE HS ( Hatching Survival(d14) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.965	0.072	0.616	0.607	USE PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	22.93	14.86	3.84	64.81	14.70, 31.16
Dose1	15	25.40	12.79	3.30	50.37	18.31, 32.49
Dose2	16	21.38	12.61	3.15	58.98	14.66, 28.09
Dose3	16	22.00	11.76	2.94	53.47	15.73, 28.27

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	22.00	1.00	43.00	.	.
Dose1	26.00	0.00	46.00	110.76	-10.76
Dose2	21.50	1.00	42.00	93.20	6.80
Dose3	18.00	0.00	41.00	95.93	4.07

\*\*\*\*\*

## PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	58	0.28	0.838

Dunnett - testing each trt mean signif. less than control

Williams - test assumes dose-response relationship, testing negative trend

Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic mean	Williams p-value	Tukey p-values				
					Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	22.93	.	24.17	.	0.954	0.987	0.997	.	.
Dose1	25.40	0.895	24.17	0.690	.	0.825	0.886	.	.
Dose2	21.38	0.613	21.69	0.498	.	.	0.999	.	.
Dose3	22.00	0.670	21.69	0.515	.	.	.	.	.

## SUMMARY

Dunnett	NOEC	LOEC
Williams	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE HS\_ES ( HatchingSurvival/EggsSet (%) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.947	0.009	1.050	0.377	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	52.54	27.84	7.19	53.00	37.12, 67.96
Dose1	15	53.90	23.22	5.99	43.07	41.04, 66.76
Dose2	16	56.72	20.33	5.08	35.85	45.88, 67.55
Dose3	16	51.14	20.68	5.17	40.44	40.12, 62.16

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	59.26	2.08	81.48	.	.
Dose1	50.94	0.00	82.14	102.59	-2.59
Dose2	56.53	16.67	91.89	107.95	-7.95
Dose3	52.73	0.00	82.86	97.34	2.66

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	0.40	0.940

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	59.26	.	.
Dose1	50.94	1.000	0.500
Dose2	56.53	1.000	0.492
Dose3	52.73	0.876	0.310

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose3	>highest dose
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE HS\_NH ( HatchingSurvival/NumberHatched (%) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.883	<.001	3.315	0.026	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	83.54	11.97	3.09	14.33	76.91, 90.17
Dose1	15	66.82	26.07	6.73	39.02	52.38, 81.25
Dose2	16	78.13	19.29	4.82	24.69	67.85, 88.41
Dose3	15	71.70	12.26	3.17	17.10	64.91, 78.49

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	85.71	61.54	100.00	.	.
Dose1	79.31	0.00	93.88	79.98	20.02
Dose2	85.18	25.00	94.44	93.53	6.47
Dose3	75.00	40.74	87.88	85.83	14.17

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	8.90	0.031

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	85.71	.	.
Dose1	79.31	0.091	0.024
Dose2	85.18	1.000	0.389
Dose3	75.00	0.029	0.045

SUMMARY	NOEC	LOEC
<b>MannWhit (Bonf adjust)</b>	<b>Dose2</b>	<b>Dose3</b>
Jonckheere	Dose2	Dose3

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE THICK ( Eggshell thickness )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.977	0.303	0.263	0.852	USE PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	0.20	0.01	0.00	4.89	0.20, 0.21
Dose1	15	0.20	0.01	0.00	4.90	0.20, 0.21
Dose2	16	0.21	0.01	0.00	5.77	0.20, 0.21
Dose3	16	0.20	0.01	0.00	4.76	0.20, 0.21

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	0.21	0.19	0.22	.	.
Dose1	0.21	0.19	0.22	99.41	0.59
Dose2	0.21	0.18	0.22	101.25	-1.25
Dose3	0.21	0.18	0.22	100.14	-0.14

\*\*\*\*\*

## PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	58	0.35	0.789

Dunnett - testing each trt mean signif. less than control

Williams - test assumes dose-response relationship, testing negative trend

Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic mean	Williams p-value	Tukey p-values				
					Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	0.20	.	0.20	.	0.989	0.905	1.000	.	.
Dose1	0.20	0.621	0.20	0.638	.	0.751	0.979	.	.
Dose2	0.21	0.924	0.20	0.674	.	.	0.928	.	.
Dose3	0.20	0.774	0.20	0.670	.	.	.	.	.

SUMMARY

Dunnett	NOEC	LOEC
Williams	Dose3	>highest dose
	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE HATWT ( Hatchling Weight )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05

Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.981	0.481	1.934	0.134	USE PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	7.02	0.42	0.11	6.04	6.78, 7.25
Dose1	15	7.21	0.61	0.16	8.41	6.87, 7.55
Dose2	16	7.26	0.68	0.17	9.35	6.90, 7.63
Dose3	15	6.88	0.39	0.10	5.60	6.67, 7.09

Level	Median	Min	Max	% of Control(means)	%Reduction(means)
Ctrl	7.06	6.30	8.00	.	.
Dose1	7.20	6.20	8.40	102.76	-2.76
Dose2	7.30	5.70	8.30	103.51	-3.51
Dose3	6.90	6.10	7.70	98.02	1.98

\*\*\*\*\*

PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	57	1.65	0.187

Dunnett - testing each trt mean signif. less than control

Williams - test assumes dose-response relationship, testing negative trend

Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic mean	Williams p-value	Tukey p-values				
					Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	7.02	.	7.17	.	0.762	0.587	0.896	.	.
Dose1	7.21	0.963	7.17	0.851	.	0.993	0.343	.	.
Dose2	7.26	0.982	7.17	0.881	.	.	0.207	.	.
Dose3	6.88	0.450	6.88	0.321	.	.	.	.	.

SUMMARY	NOEC	LOEC
Dunnett	Dose3	>highest dose
Williams	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE SURVWT ( Survivor Wt (d14) )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.840	<.001	3.330	0.026	USE NON-PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	24.85	7.44	1.92	29.95	20.73, 28.97
Dose1	14	24.00	2.36	0.63	9.84	22.63, 25.36
Dose2	16	26.50	3.97	0.99	14.98	24.38, 28.61
Dose3	15	25.39	2.06	0.53	8.11	24.25, 26.53

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	23.40	16.90	46.60	.	.
Dose1	23.50	21.20	29.10	96.58	3.42
Dose2	26.50	20.05	34.70	106.64	-6.64
Dose3	26.10	20.44	27.78	102.17	-2.17

\*\*\*\*\*

## NON-PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Kruskal-Wallis test - equality among treatment groups

Degrees of Freedom	TestStat	P-value
3	6.93	0.074

MannWhit(Bon) - testing each trt median signif. less than control

Jonckheere - test assumes dose-response relationship, testing negative trend

Level	Median	MannWhit(Bon adjust)p-value	Jonckheere p-value
Ctrl	23.40	.	.
Dose1	23.50	1.000	0.578
Dose2	26.50	1.000	0.979
Dose3	26.10	1.000	0.982

SUMMARY	NOEC	LOEC
MannWhit (Bonf adjust)	Dose3	>highest dose
Jonckheere	Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE FOOD ( Food Consumption )

## TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS

Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.

Shapiro-Wilks	Shapiro-Wilks	Levenes	Levenes	Conclusion
Test Stat	P-value	Test Stat	P-value	
0.990	0.879	1.663	0.185	USE PARAMETRIC TESTS

\*\*\*\*\*

## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	34.85	2.95	0.76	8.46	33.22, 36.49
Dose1	15	34.95	2.36	0.61	6.75	33.64, 36.25
Dose2	16	34.74	2.92	0.73	8.41	33.19, 36.30
Dose3	16	34.79	1.81	0.45	5.22	33.83, 35.76

Level	Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl	35.30	29.30	39.10	.	.
Dose1	33.90	32.10	39.50	100.27	-0.27
Dose2	34.75	30.80	40.20	99.69	0.31
Dose3	34.55	31.60	38.20	99.83	0.17

\*\*\*\*\*

## PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	58	0.02	0.997

Dunnett - testing each trt mean signif. less than control

Williams - test assumes dose-response relationship, testing negative trend

Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic mean	Williams p-value	Tukey p-values				
					Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	34.85	.	34.90	.	1.000	0.999	1.000	.	.
Dose1	34.95	0.782	34.90	0.605	.	0.996	0.998	.	.
Dose2	34.74	0.702	34.77	0.577	.	.	1.000	.	.
Dose3	34.79	0.723	34.77	0.595	.	.	.	.	.

SUMMARY NOEC LOEC

Dunnett Dose3 >highest dose  
Williams Dose3 >highest dose

## Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE WTGAINM ( Male wt gain )

TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS  
 Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
 Levene's test for homogeneity of variance (absolute residuals) -- alpha-level=0.05  
 Use parametric analyses if neither test rejected, otherwise non-parametric analyses.  

Shapiro-Wilks	Shapiro-Wilks	Levene's	Levene's	
Test Stat	P-value	Test Stat	P-value	Conclusion
0.995	0.995	0.898	0.448	USE PARAMETRIC TESTS

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## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	9.93	13.14	3.39	132.33	2.65, 17.21
Dose1	15	11.27	18.06	4.66	160.31	1.26, 21.27
Dose2	16	4.00	11.98	3.00	299.58	-2.39, 10.39
Dose3	16	9.81	13.04	3.26	132.89	2.86, 16.76

Level	Median	Min	Max	% of Control (means)	% Reduction (means)
Ctrl	10.00	-12.00	29.00	.	.
Dose1	13.00	-25.00	41.00	113.42	-13.42
Dose2	2.50	-16.00	25.00	40.27	59.73
Dose3	6.00	-8.00	45.00	98.78	1.22

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PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	58	0.82	0.489

Dunnett - testing each trt mean signif. less than control

Dunnett - testing each treatment mean significant than control  
Williams - test assumes dose-response relationship, testing negative trend

Williams test assumes dose-response relationship, testing negative trend. Tukey - two-sided tests - all possible comparisons - not used for NOEC or LOEC

Level	Mean	Dunnett	Isotonic	Williams	Tukey p-values				
		p-value	mean	p-value	Dose1	Dose2	Dose3	Dose4	Dose5
Ctrl	9.93	.	10.60	.	0.994	0.652	1.000	.	.
Dose1	11.27	0.831	10.60	0.637	.	0.490	0.992	.	.
Dose2	4.00	0.261	6.91	0.354	.	.	0.655	.	.
Dose3	9.81	0.738	6.91	0.367	.	.	.	.	.

SUMMARY		NOEC	LOEC
Dunnett		Dose3	>highest dose
Williams		Dose3	>highest dose

# Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus*

EPA MRID Number 48444809

Bobwhite repro, Glufosinate ammonium, MRID 48444809  
ANALYSIS RESULTS FOR VARIABLE WTGAINF ( Female wt gain )

TESTS OF ASSUMPTIONS FOR PARAMETRIC ANALYSIS  
Shapiro-Wilks test for Normality of Residuals -- alpha-level=0.01  
Levenes test for homogeneity of variance(absolute residuals) -- alpha-level=0.05  
Use parametric analyses if neither test rejected, otherwise non-parametric analyses.  
Shapiro-Wilks Test Stat P-value Levenes Test Stat P-value Conclusion  
Ctrl 0.953 0.018 2.036 0.119 USE PARAMETRIC TESTS

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## BASIC SUMMARY STATISTICS

Level	N	Mean	StdDev	StdErr	Coef of Var	95% Conf. Interval
Ctrl	15	39.27	12.60	3.25	32.09	32.29, 46.24
Dose1	15	40.80	19.50	5.04	47.80	30.00, 51.60
Dose2	16	31.88	24.77	6.19	77.72	18.67, 45.08
Dose3	16	33.94	16.62	4.16	48.98	25.08, 42.80
Level		Median	Min	Max	%of Control(means)	%Reduction(means)
Ctrl		41.00	5.00	60.00	.	.
Dose1		41.00	6.00	65.00	103.90	-3.90
Dose2		35.00	-19.00	67.00	81.18	18.82
Dose3		36.50	-9.00	59.00	86.43	13.57

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PARAMETRIC ANALYSES - use alpha-level=0.05 for all tests

Analysis of Variance (ANOVA) - overall F-test

Numerator df	Denominator df	F-stat	P-value
3	58	0.78	0.512

Dunnett - testing each trt mean signif. less than control

Williams - test assumes dose-response relationship, testing negative trend

Tukey - two-sided tests, all possible comparisons, not used for NOEC or LOEC

Level	Mean	Dunnett p-value	Isotonic p-value	Williams p-value	Tukey p-values
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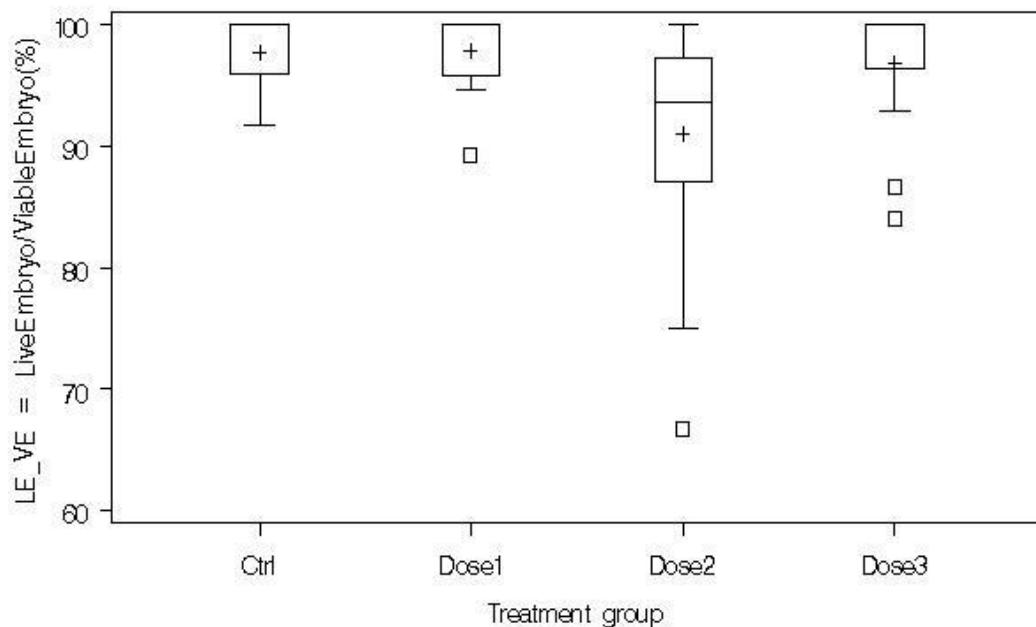
Ctrl	39.27	.	40.03	.	Dose1	Dose2	Dose3	Dose4	Dose5
Dose1	40.80	0.820	40.03	0.630	.	0.561	0.747	.	.
Dose2	31.88	0.290	32.91	0.227	.	.	0.990	.	.
Dose3	33.94	0.414	32.91	0.235	.	.	.	.	.

SUMMARY	NOEC	LOEC
Dunnett	Dose3	>highest dose
Williams	Dose3	>highest dose

**Data Evaluation Record on the Reproductive Effects of Glufosinate Ammonium Technical on Avian Species *Colinus virginianus***

EPA MRID Number 48444809

**Bobwhite repro, Glufosinate ammonium, MRID 48444809**



**Bobwhite repro, Glufosinate ammonium, MRID 48444809**

